



*City of Eugene*

# ***2010 Internal Greenhouse Gas Inventory***

October 2012



# ***Acknowledgements***

This City of Eugene internal greenhouse gas inventory was conducted by a team of staff with support and oversight provided by Good Company. Many City staff contributed to the GHG inventory, including Matt Rodrigues, Babe O'Sullivan, Lynne Eichner, Heather Nelson, Peggy Keppler, Sharon Olson, Kandy Hanes and Matt McRae.

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## **INTRODUCTION AND POLICY CONTEXT**

The Intergovernmental Panel on Climate Change, the United Nations body that regularly convenes climate scientists, has identified human activity as the primary cause of the climate change that has occurred over the past few decades and quickened in recent years. Consensus statements from the IPCC suggest that human-caused greenhouse gas (GHG) emissions must be reduced significantly – perhaps more than 50% globally, and by 80% in wealthier nations that are the largest emitters – by mid-century in order to avoid the worst potential climate impacts on human economies.

Many corporations, government agencies, universities, non-profits and even individuals have proactively sought to take on this challenge. Emissions from city government operations can be significant. Likewise, cities can create a substantial positive impact through emissions reductions. Cities also have a role in educating policy makers and citizens. By measuring greenhouse gas emissions from the City's operations, this inventory informs decision makers as strategies are developed to take action, to manage risk and lead the way forward.

There has recently been much regulatory action regarding GHG emissions, as well as energy- and transportation-related legislation and policy related to climate change. Action is taking place at the international, national, regional, state and local levels as shown in Figure 1.

<b>SCALE</b>	<b>RECENT ACTIVITY</b>
International	The world's leaders are meeting annually to negotiate the next international climate agreement to follow the Kyoto Protocol, which is set to expire in 2012. While none of the recent Summits resulted in any legally binding emissions reductions targets, the Copenhagen Accord, drafted in December 2009 by the United States, China, Brazil, India and South Africa, calls for nations to take actions to keep increases in global temperatures below two degrees Celsius.
Federal	In 2007, the Supreme Court unanimously ruled that the US Environmental Protection Agency (EPA) has the authority to regulate greenhouse gas emissions under the Clean Air Act. The EPA has issued mandatory reporting guidelines for large emitters. Other energy and economic stimulus legislation passed by the federal government supports renewable energy development and other climate-related initiatives.
Regional	The three regional initiatives – Western Climate Initiative (WCI), Midwest Greenhouse Gas Accord (MGGA), and Regional Greenhouse Gas Initiative (RGGI) – continue to move forward and prepare for implementation. RGGI has been underway since 2008 regulating emissions from utilities providers. The WCI got underway at the beginning of 2012 with a cap and trade system being rolled out in California as part of AB-32, the state's landmark climate bill.
State	In Oregon, recent legislation includes climate and energy bills targeting fuels, solar power opportunities, and GHG emissions from land use and transportation. A number of statewide efforts are facilitating the widespread deployment of electric vehicles. Dozens of states are taking these and similar actions.
Local	<p>At the local level, over 1,000 cities across the country have signed the US Mayors Climate Protection Agreement, 16 are in Oregon and include the City of Eugene. This is Eugene's second internal GHG inventory and an important step in continuing to track and reduce emissions.</p> <p>In 2009 Eugene's City Council adopted the goal that all City-owned facilities and City operations shall be "carbon neutral" by 2020 (i.e. shall reduce net carbon emissions to zero, or if that is not possible, cancel all remaining scope 1 and scope 2 emissions through the funding of approved local offset mechanisms or the purchase of approved high-quality carbon offsets).</p>

**Figure 1: Overview of Policy Activity Related to Greenhouse Gas Emissions Management**

## CURRENT GREENHOUSE GAS - RELATED REGULATORY REQUIREMENTS

### Mandatory Reporting in Oregon

While the Oregon Department of Environmental Quality (DEQ) requires GHG reporting for a wide range of entities, there is currently no regulation requiring the City of Eugene to conduct an internal greenhouse gas inventory. The threshold for reporting is currently set at 2,500 MT CO<sub>2</sub>e (metric tons carbon dioxide equivalent<sup>[1]</sup>) annually. In general, entities required to report must have at least one discrete permitted source emitting above the threshold. While the City of Eugene's aggregate emissions are above 2,500 MT CO<sub>2</sub>e, it does not have a single discrete source that meets this threshold so there is no current requirement that the City of Eugene report these operational GHGs to DEQ.

For more information on Oregon's rules, visit DEQ's GHG reporting page: [www.deq.state.or.us/aq/climate/reporting.htm](http://www.deq.state.or.us/aq/climate/reporting.htm)

## INVENTORY BOUNDARIES

In many GHG inventory protocols, emissions sources and activities are classified as either producing direct or indirect GHG emissions. Direct emissions are those that stem from sources owned or controlled by a particular organization. Indirect emissions occur because of the organization's actions, but the direct source of emissions is controlled by a separate entity.

To distinguish direct from indirect emissions sources, three "scopes" are defined for traditional GHG accounting and reporting purposes.

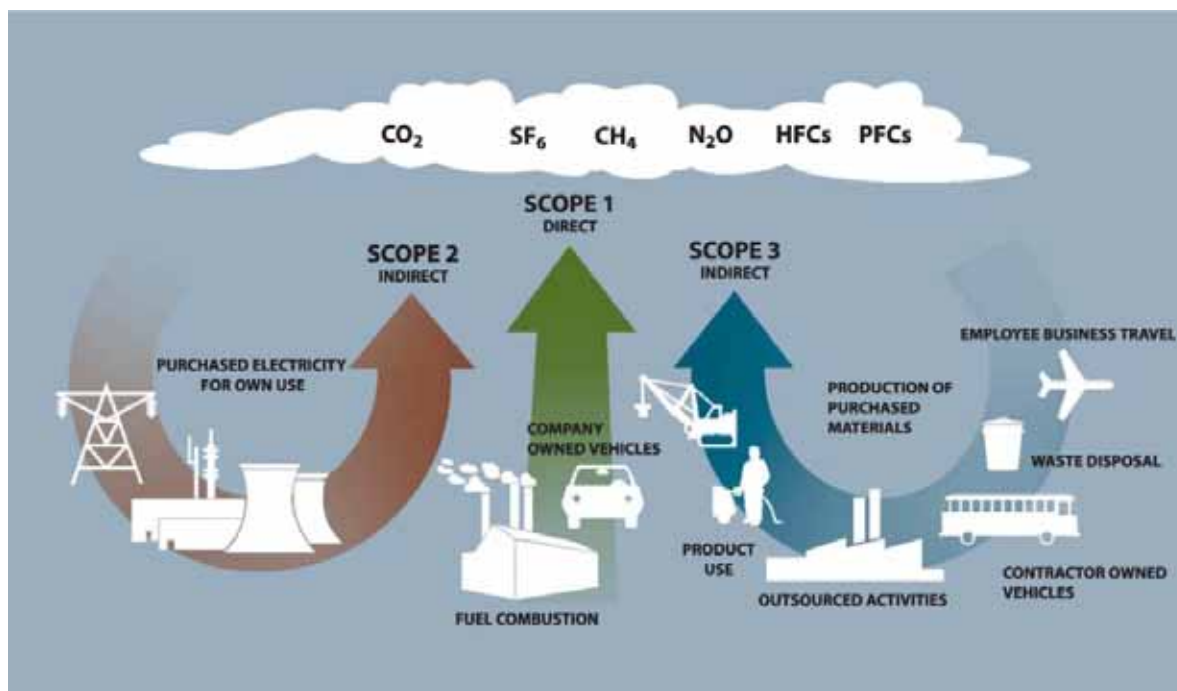
**Scope 1** – Direct sources of GHG emissions that originate from equipment and facilities owned or operated by the City of Eugene. This includes burning gasoline and diesel in City vehicles as well as natural gas burned to heat buildings.

**Scope 2** – Indirect GHG emissions from purchased electricity or steam. This includes electricity and steam purchased from the Eugene Water & Electric Board (EWEB) used to heat and light buildings, power equipment and operate computers.

**Scope 3** – All other indirect sources of GHG emissions that may result from the activities of the City but occur from sources owned or controlled by another company or entity, such as: business air travel; embodied emissions in material goods purchased by the City to provide services; emissions from landfilled solid waste; and the commuting habits of City employees.

<sup>[1]</sup> Carbon dioxide equivalent is a measure of the amount of warming that would occur from a mix of greenhouse gas emissions over a period of time (typically 100 years). The unit is a comparison to the amount of warming that would be caused by a given amount of carbon dioxide.

Scope 1 (direct) and Scope 2 (indirect) emissions must be reported for most protocols and registries. Scope 3 emissions are indirect and usually considered optional when reporting emissions, but serve to clarify an organization's entire carbon footprint and illuminate the potential regulatory and financial risks an institution may face due to its carbon footprint. Figure 2 illustrates the three scopes of emissions.



**Figure 2: Greenhouse Gases and Accounting and Reporting Scopes. Source: WRI/ WECSG Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard (Revised Edition)**

Eugene maintains two different types of greenhouse gas inventories: a local government operations inventory (such as this one) and a community greenhouse gas inventory.

This local government operations GHG inventory draws its boundaries around activities necessary for the city government to fulfill its mission. These activities are conducted on behalf of the citizens and businesses that live and work in the community.

Eugene's community GHG inventory draws its boundaries around a geographic location and includes all the activities and emissions sources needed to serve that area including government, citizen and business activities.

This local government operations inventory is one component of Eugene's greater community-wide inventory available online at: [www.eugene-or.gov/sustainability](http://www.eugene-or.gov/sustainability)

## SUMMARY OF RESULTS

In 2010, the City of Eugene's GHG emissions from fuel and power use by buildings and vehicles are 16,700 MT CO<sub>2</sub>e, described below as Scope 1 and Scope 2 (as defined by the World Resources Institute). In addition, this inventory identified an estimated 29,000 MT CO<sub>2</sub>e of other emissions from mission-critical activities related to the City's operations but outside of its direct control (Scope 3).

Scopes 1, and 2 yield 16,700 MT CO<sub>2</sub>e. For sense of scale, this is equivalent to the annual greenhouse gas emissions from 2,971 passenger vehicles<sup>[2]</sup>.

Scope 3 emissions yield an estimated 29,000 MT CO<sub>2</sub>e. For sense of scale, this is equivalent to the annual greenhouse gas emissions from 5,159 passenger vehicles.

<sup>[2]</sup> EPA equivalency calculator [www.epa.gov/cleanenergy/energy-resources/calculators.html](http://www.epa.gov/cleanenergy/energy-resources/calculators.html)



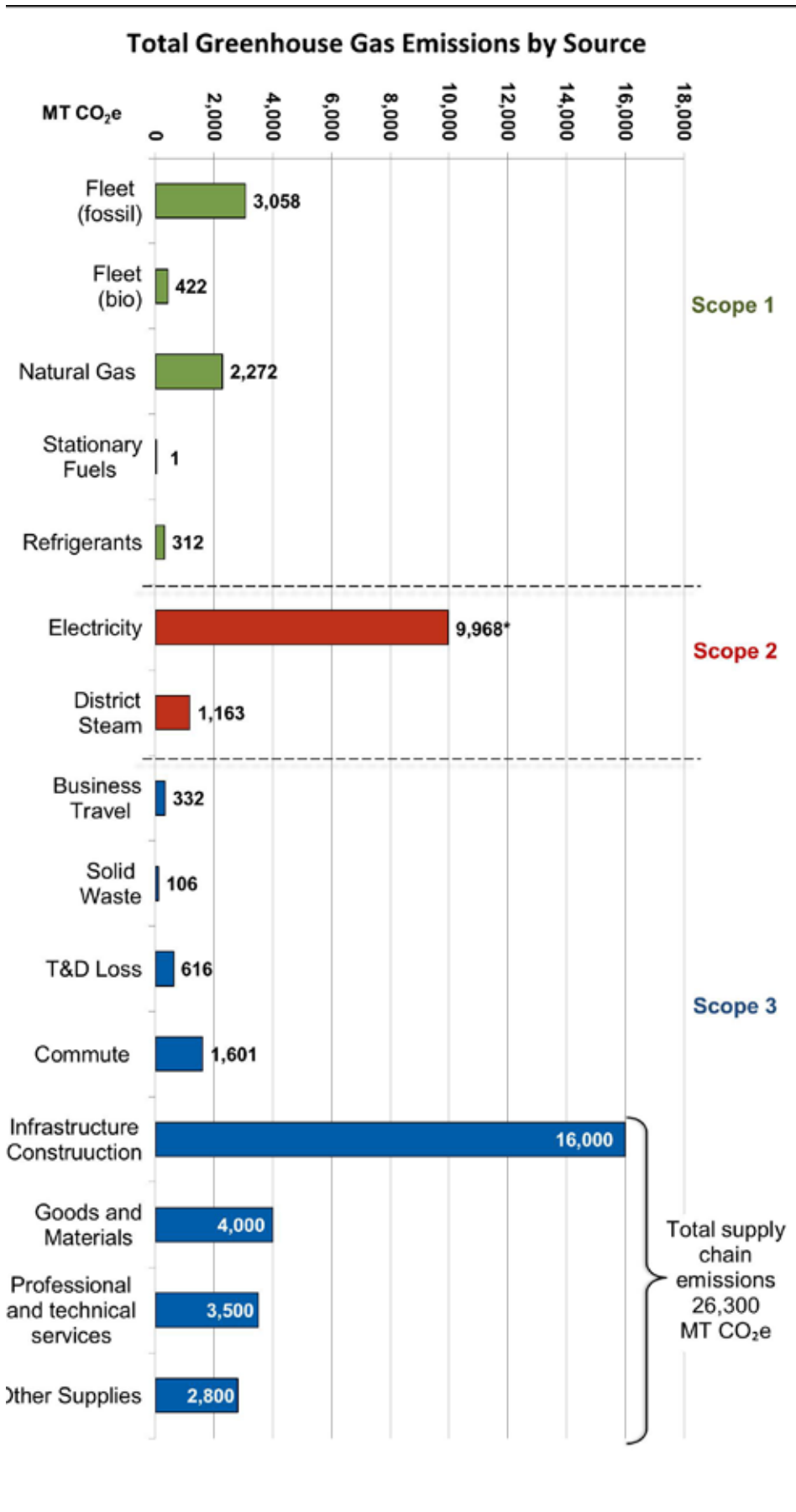


Figure 3: Eugene's Greenhouse Gas Emissions from Local Government Operations (2010)

\*Electricity emissions calculated using the emissions factor for the regional electricity grid. For comparisons with other emissions factors see Figure 4: Description of the City of Eugene's Greenhouse Gas Emissions Categories.

WRI Scope	Emissions Category	2010 MT CO <sub>2</sub> e	Description
Scope 1 (Direct Emissions)	Fleet	3,480	<p>This emissions category includes emissions from the burning of gasoline, ethanol, diesel and biodiesel in the following equipment:</p> <ul style="list-style-type: none"> <li>• Cars and light trucks including 95 gasoline-electric hybrid vehicles</li> <li>• Heavy trucks</li> <li>• Tractors</li> <li>• Utility equipment such as chippers, compacters, and leaf blowers.</li> </ul> <p>Fuels:</p> <ul style="list-style-type: none"> <li>• Gasoline: 188,698 gallons</li> <li>• Ethanol: 20,966 gallons</li> <li>• Diesel: 133,913 gallons</li> <li>• Biodiesel: 31,932 gallons</li> <li>• As mandated by the state, all gasoline is a blend of 90% unleaded gasoline mixed with 10% ethanol</li> <li>• Diesel equipment is powered by a blend of 80% petroleum diesel mixed with 20% biodiesel</li> <li>• These measurements are for tailpipe emissions only. Emissions associated with extracting, processing, and distributing fuels are not included.</li> </ul>
	Natural gas	2,272	428,493 therms of natural gas were used for heating buildings and water in facilities owned by the City of Eugene. Nearly half of this natural gas is used to heat public swimming pools.
	Other Stationary fuels	<1	Public Works and Central Services use small amounts (86 gallons total) of diesel fuel in backup generators.
	Refrigerants	313	Due to leaks, Eugene recharged air conditioning systems with the following refrigerants: 360 pounds of HCFC-22, 58 pounds of HFC-134A, and 2 pounds of R-410A.
Scope 2 (Indirect Emissions)	Electricity	9,968	The city consumed 25,452,824 kWh of electricity for buildings, streetlights and traffic signals, and in parks and open spaces. This emissions total was calculated using the regional EPA eGRID emissions factor for the Northwest Power Pool. (For information for how this emissions factor compares to our utility specific emissions factor for the Eugene Water & Electric Board, see Methods below).
	District Steam	1,163	The City purchased 10,775 thousand pounds of steam from the Eugene Water & Electric Board to heat City Hall, the Hult Center for the Performing Arts, the Atrium building, and the lower levels of the Parkade and Overpark parking structures <sup>[3]</sup> . EWEB is discontinuing this service and by the end of 2012 no city-owned or operated facilities will be using steam for heat.

<sup>[3]</sup> City owned and operated spaces but primarily occupied by tenants.

WRI Scope	Emissions Category	2010 MT CO <sub>2</sub> e	Description
Scope 3 (Indirect Emissions)	Business travel	332	These emissions result primarily from air travel related to business activities such as training and conferences (87% of total). The remainder of the emissions come from rental vehicles and employee-owned vehicles used for business travel.
	Solid waste	106	City operations generated 8,193 cubic yards of landfilled solid waste sent to the Short Mountain Landfill, a facility operated by Lane County that captures and burns landfill methane to produce electricity. Upwards of 60% of solid waste generated from City operations is reused, recycled, or otherwise diverted from the landfill.
	Commute	1,700	The average commute distance for Eugene employees is 9 miles one way. Approximately 61% of employees drive alone to work, 10% carpool, 11% ride the bus, 14% bike and 4% walk.
	T&D Losses	899	Transmission and distribution (T&D) losses from electricity occur as electricity travels from the point of generation to the point of consumption. They are correlated with electricity consumption but are typically omitted in GHG inventories. This figure assumes slightly more than 6% T&D losses for the US grid.
	Embodied emissions in purchased goods and services	~26,000	This category estimates the emissions associated with manufacturing of goods and provision of services that are purchased by the City of Eugene. The overwhelming majority of these emissions are associated with goods and services purchased for capital construction projects such as roads and facilities (16,000 MT CO <sub>2</sub> e). The remainder of the emissions comes from three big categories of purchases: goods and materials such as computers, office supplies and equipment (4,000 MT CO <sub>2</sub> e), professional and technical services (3,500 MT CO <sub>2</sub> e), and other supplies (2,800 MT CO <sub>2</sub> e).

Figure 4: Description of The City of Eugene's Greenhouse Gas Emissions Categories

## DISCUSSION: DATA COLLECTION, METHODS, AND ANALYSIS

The following section will discuss the data sources and calculation methods, and will highlight key findings from this inventory in addition to discussing trends based on 2005 and 2000 GHG emissions data. Additional information and conclusions can be drawn from reviewing the raw data. Raw data and additional data analysis is available upon request (contact information provided at the end of this document).

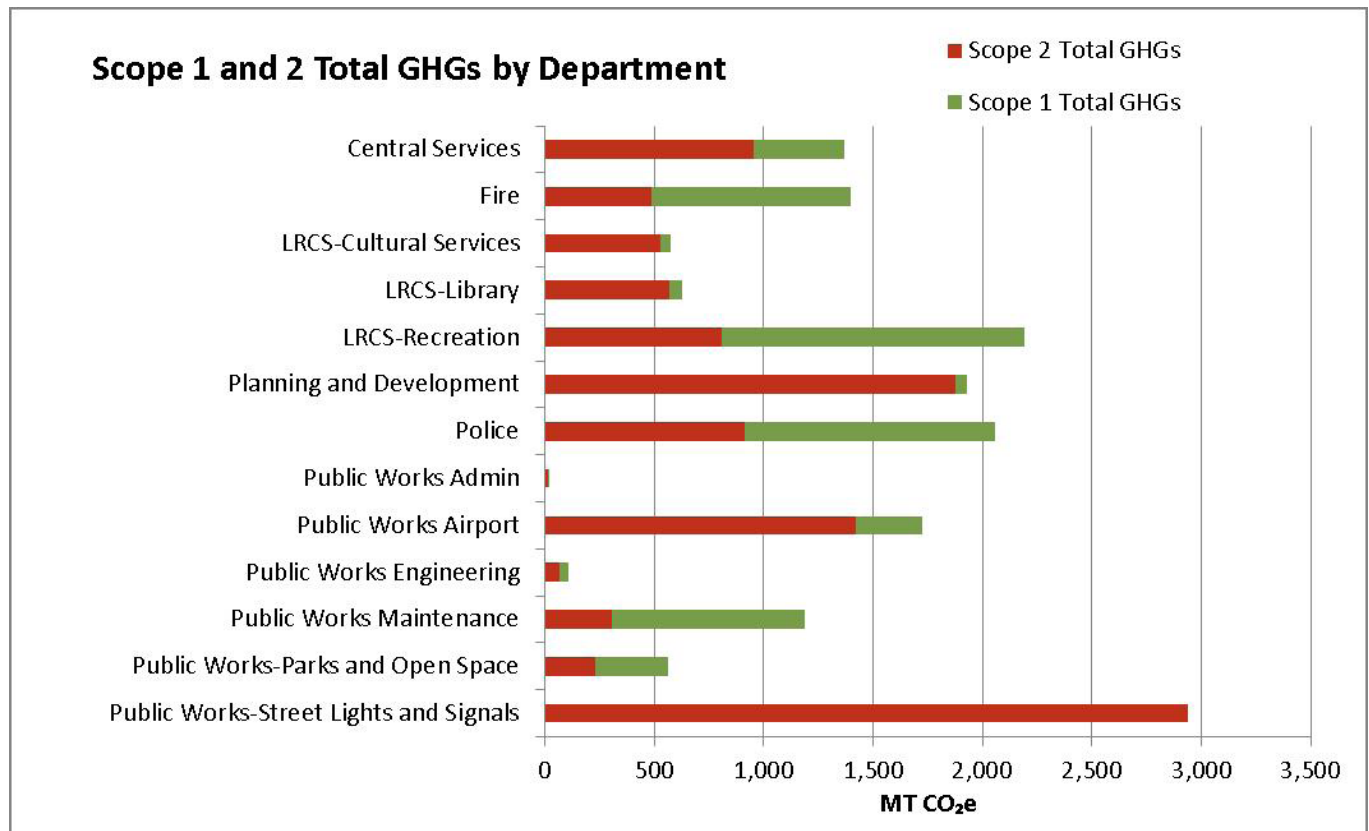
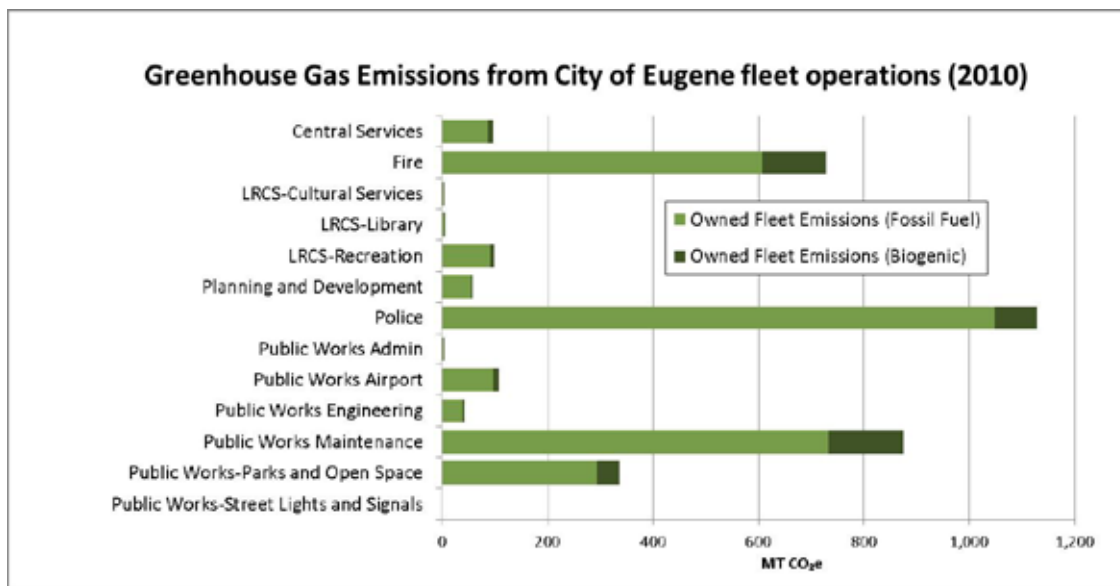


Figure 5: Scope 1 and Scope 2 total GHGs by department

## Fleet

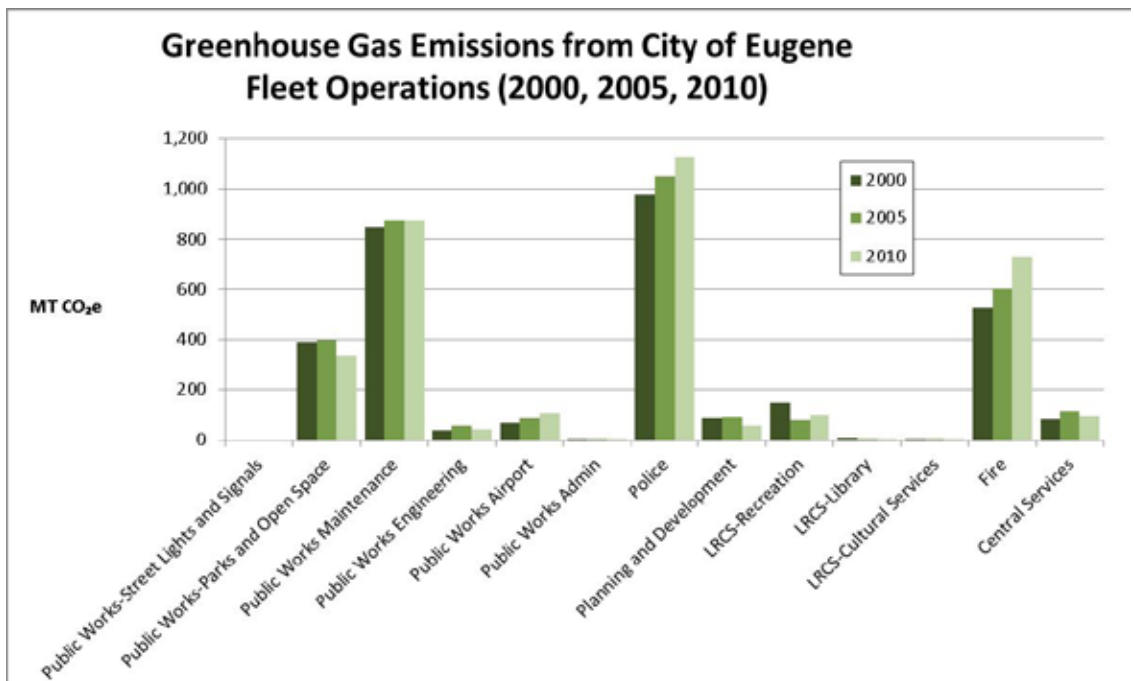
The City of Eugene purchases fuel in bulk and operates its own fueling station allowing precise measurements of fuel use across the organization. GHG emissions from operating City-owned vehicles and equipment were based on the measured total gallons of fuel used and fuel types used (E10, B20, and diesel). The small percentage of non-CO<sub>2</sub> GHG emissions (CH<sub>4</sub> and N<sub>2</sub>O emissions from incomplete combustion in vehicle internal combustion engines) are calculated based on vehicle fuel economy. Fuel economy is calculated for vehicle types (sedan, pickup, etc.) from odometer readings and measured fuel use.



**Figure 6 Greenhouse Gas Emissions from consumption of gasoline, ethanol, diesel, and biodiesel**

The largest sources of vehicle and equipment-based emissions are Police operations, Fire/EMS operations, and Public Works Maintenance operations. These numbers reflect fuel used for transportation and the small amount of non-transportation fuel use such as fuel used in leaf blowers, portable generators, chippers, plate compactors and other equipment.





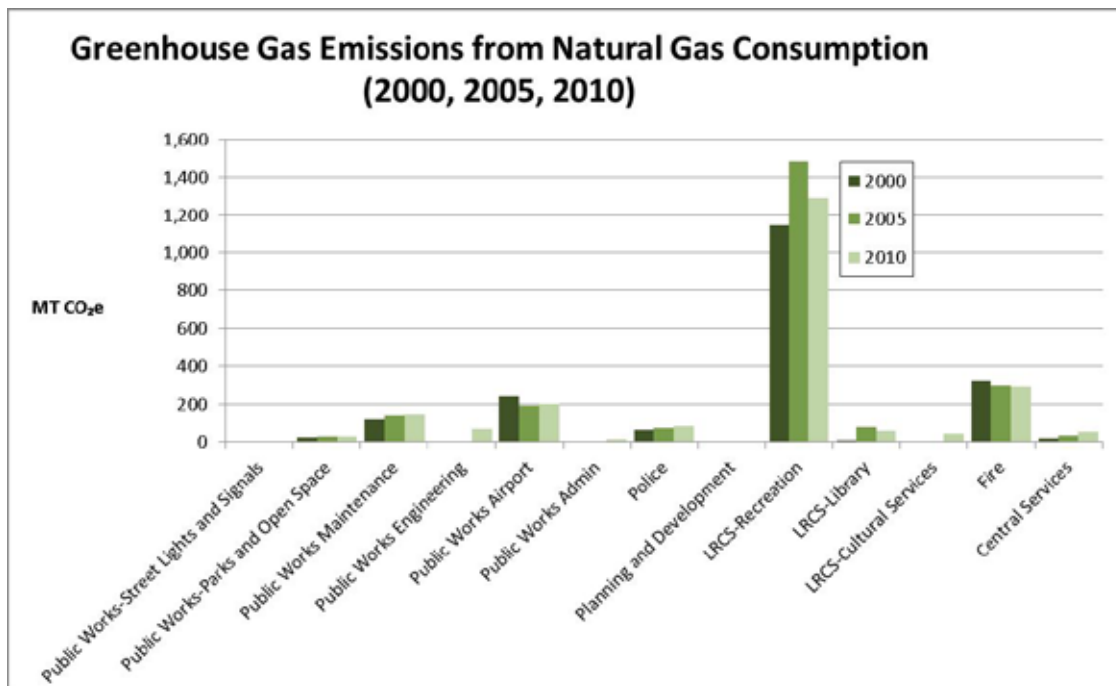
**Figure 7: Automobile fuel use over time**

### Fuel use over time

Over time, greenhouse gas emissions from gasoline and diesel use across the organization is trending upward with biofuels becoming an increasing proportion. Organization wide, transportation fuel consumption went from 338,638 gallons in 2000 to 358,634 gallons in 2005 and 375,508 gallons in 2010, an annual increase of about 1% and an annual cost of more than \$1.3 million. There are three notable exceptions in Parks and Open Space, Recreation, and Planning and Development where fuel use has dropped noticeably over 10 years. Beginning in 2009 Parks and Open Space made a concerted effort to reduce fuel use in operations. Substantial reductions were achieved by adjusting maintenance practices, using more efficient vehicles, and consolidating trips. The reductions in fuel consumption within Recreation are partly a result of switching from gasoline-powered vehicles to diesel-powered vehicles in the early 2000s. Reductions in Planning and Development stem primarily from reductions in the number of staff conducting building inspections.

### Inventory limitations related to Fleet

This inventory reports only tailpipe emissions, excluding the additional “upstream” emissions associated with extracting, processing, and distributing gasoline and diesel. Future inventories would be improved if they included these other life-cycle emissions – particularly as fuel sources across the nation change, ultimately changing the proportion of emissions associated with fossil fuel extraction. Biofuels likewise have variable life-cycle emissions that are important to understand when determining if, when, and how much to adopt use of biofuels as a greenhouse gas reduction strategy.



**Figure 8 Natural Gas Consumption in City Facilities**

## Natural Gas

Natural gas use in City owned facilities is tracked at the gas meter allowing accurate measurements. Natural gas is used in many facilities for heating buildings and heating domestic hot water for use in bathrooms. The largest use of natural gas in City operations is heating public swimming pools, under the category LRCS recreation. The size of Amazon pool was doubled in 2002 causing a related increase in natural gas consumption but pool efficiency upgrades conducted between 2005 and 2010 have caused a noticeable reduction in natural gas use. An ongoing emphasis on fine-tuning energy-using systems at both the Downtown Library and the Hult Center for the Performing has achieved results for both LRCS-Library and Cultural Services respectively in reducing natural gas use.

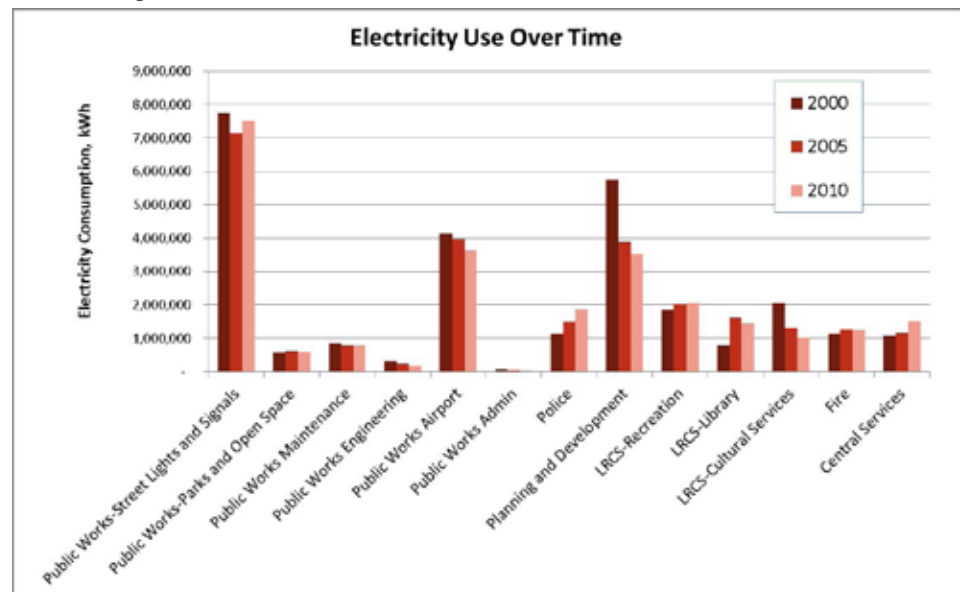
## Other Stationary Fuels

This category includes a relatively small number of generators primarily used for backup electricity generation during a power outage. These generators are present at the library, Public Works and a number of other essential facilities. A small amount of fuel is used in these generators each year to test the equipment and maintain engine viability.

## Refrigerants

The City of Eugene uses the refrigerant HCFC-22 in numerous heating, ventilation and air conditioning (HVAC) systems. Refrigerant “use” in HVAC systems occurs during maintenance activities and is due to leakage caused when seals or gaskets fail allowing refrigerant to escape into the atmosphere. In 2010 the largest source (89%) of refrigerant-related GHG emissions was the release of 360 lbs. of HCFC-22. While a fairly small amount of product, the impact is significant because HCFC-22 delivers 1700 times the warming effect of CO<sub>2</sub> over 100 years. Because of this extremely high global warming potential (GWP) and the effect this chemical has on ozone depletion, HCFC-22 is being phased out under the Montreal Protocol. Leaks in HVAC systems also resulted in the release of 58 pounds of HFC-134A, and 2 pounds of R-410A with GWP of 3,800 and 1,725 respectively.

## Electricity

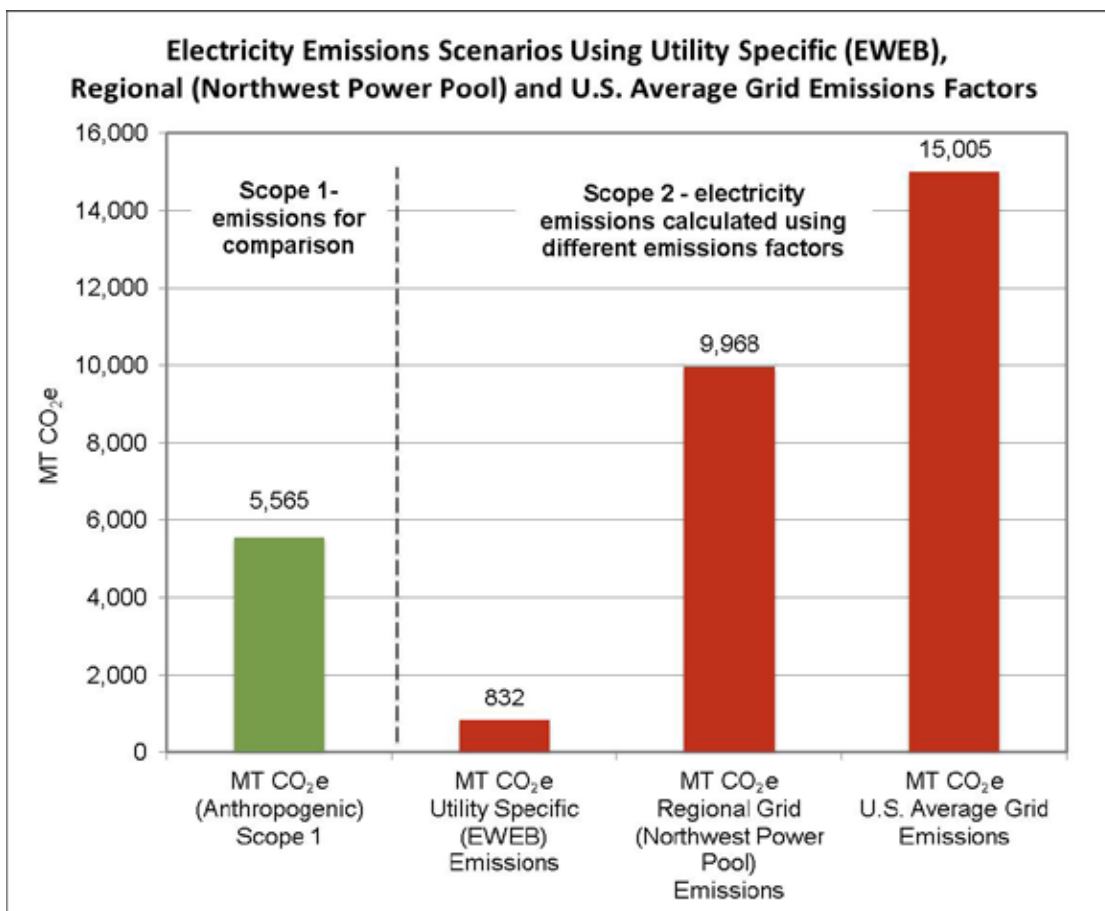


**Figure 9: Electricity use in City facilities**

Electricity data is tracked centrally and based on utility billing. Electricity is used in facilities for lighting, heating, operating computers, operating small equipment, and many other uses. The sharp drop in electricity use in Planning and Development stems from a whole building energy retrofit conducted on the Atrium building between 2000 and 2005. An ongoing emphasis on fine-tuning energy-using systems at both the Downtown Library and the Hult Center for the Performing Arts has achieved results for both LRCs-Library and Cultural Services respectively in reducing electricity use. An administrative order enacted in 2009 set a new standard for thermostat settings in buildings <sup>[4]</sup> and contributed to reduced electricity and natural gas use.

[4] “Standard thermostat settings for City work environments shall be 69° for heating and 76° for cooling. Standard thermostat settings during unoccupied times for all City buildings are 55° for heating and 80° for cooling.”





**Figure 10: electricity emissions scenarios for City of Eugene using local, regional and national emissions factors.**

## The importance of electricity emissions factors

One of the single most impactful assumptions in this greenhouse gas inventory is the emissions factor used to calculate emissions from electricity use. Figure 10 illustrates a sensitivity analysis for electricity consumption based on multiple emissions factors.

For this inventory calculations are based on the regional emissions factor<sup>[5]</sup> (863 lbs. CO<sub>2</sub>/MWh)<sup>[6]</sup> as recommended by The Climate Registry in The Local Government Operations Protocol<sup>[7]</sup>. The disparity in emissions factors between the local and regional electricity providers is exceptional in Eugene due to the ultra low-carbon electricity provided by EWEB (72 lbs/MWh)<sup>[8]</sup>. This low number is a result of several factors including many decisions by EWEB to invest in low-carbon electricity options when possible and because, as a publicly-owned utility, EWEB receives priority access to hydroelectric power from the Bonneville Power Administration.

<sup>[5]</sup> Previous City of Eugene Internal GHG inventories have used the local emissions factor. In order to be consistent with national inventory standards and inventories compiled by municipal governments across the nation, this inventory relies on the more conservative regional grid emissions factors.

<sup>[6]</sup> EPA Egrid emissions factors: [www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1\\_1\\_year07\\_SummaryTables.pdf](http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010V1_1_year07_SummaryTables.pdf)

<sup>[7]</sup> The Climate Registry: [www.theclimateregistry.org/resources/protocols/local-government-operations-protocol](http://www.theclimateregistry.org/resources/protocols/local-government-operations-protocol)

<sup>[8]</sup> 2010 EWEB greenhouse gas inventory. [www.eweb.org/public/documents/sustainability/GHGreport2010.pdf](http://www.eweb.org/public/documents/sustainability/GHGreport2010.pdf)

## Business Travel

Business travel was estimated based on records of purchase for accommodations, air travel and train travel. With an estimated 513,000 person miles travelled in 2010, air travel accounts for 87% of the GHGs in this category. Because travel purchases are not a separate category of purchases and therefore not categorized consistently across the organization, the estimate for this category is only partially reported. Total miles of employee air travel were estimated based on airline ticket purchase price, a variable that changes over the year in response to a number of factors. Future inventories can be improved by tracking and reporting travel as a separate category of purchases.

## Solid Waste

Quantities of solid waste generated by City departments are tracked centrally and based on billings provided by our waste hauler. In 2010 City operations generated 8,193 cubic yards of solid waste that was landfilled. This waste is transported to the Short Mountain Landfill, a facility operated by Lane County that captures and burns landfill methane to produce electricity. It is worth noting that, based on estimates from the City's waste hauling contractor, upwards of 60% of solid waste from City operations is reused, recycled, or otherwise diverted from the landfill.

## Commute

Emissions from employee commute were estimated based on data from a survey sent out via email to all employees. Employees were asked about the distance to work, their mode of travel, and the vehicle they used for commuting. Approximately 600 employees completed the survey, a response rate of 43%. The response from employees without access to a computer (typically those in the field like many staff in Public Works) were likely underrepresented in this survey. Survey results suggest that approximately 61% of employees drive to work alone while 14% bike, 11% ride the bus, 10% carpool, and 4% walk.

### Employee commute to work

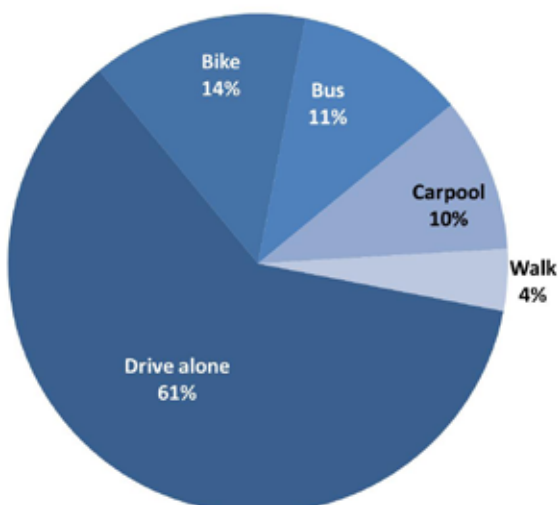
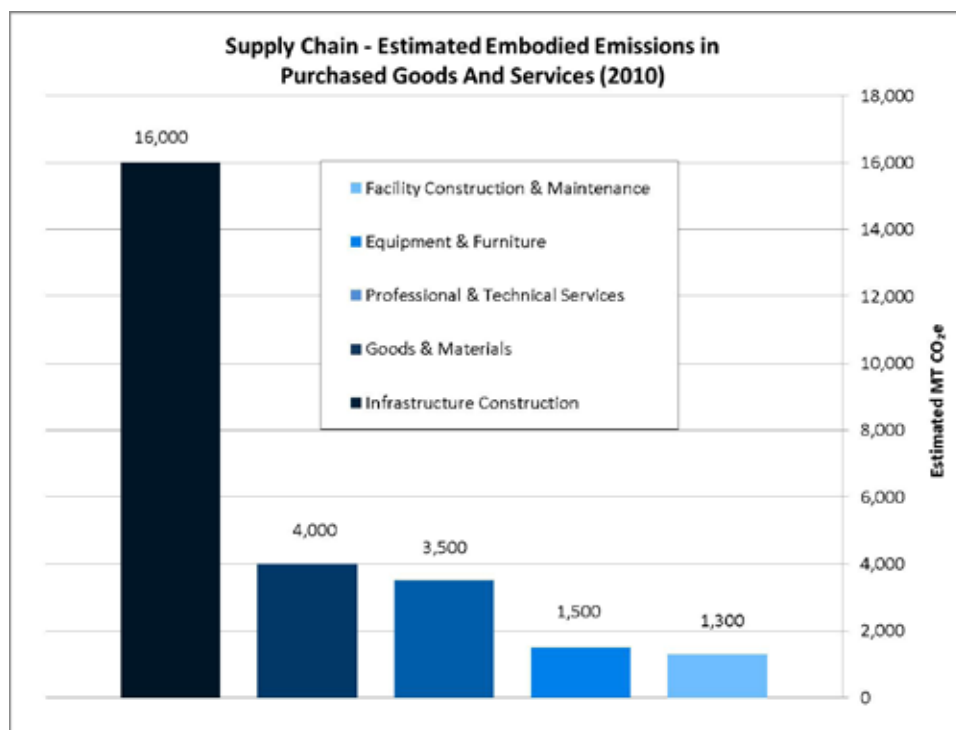


Figure 11: Employee commute to work based on results of employee survey

## Embodied Emissions in Purchased Goods and Services



**Figure 12: Estimated supply chain emissions across five primary purchasing categories**

Embodied emissions are those emissions associated with the upstream production of supplies and services that an organization purchases. The emissions are the result of manufacturing processes including resource extraction, manufacturing and transportation up to the point of purchase. Unlike Scope 1 impacts, these emissions are not directly controlled by the City and are difficult to measure accurately.

In calendar year 2010, the City purchased about \$80 million worth of goods and services. Certain items were immediately excluded from this actual expenditure amount for the purposes of this analysis. These exclusions consisted of employee benefit compensations, strictly financial transactions that did not go towards the purchase of goods or services, and grant distributions as well as any item already accounted for elsewhere in the inventory such as fuel, water, garbage service, transportation and electricity purchases. Because of the way purchases are tracked and categorized internally, and due to the limitations of the EIO-LCA<sup>[9]</sup> tool used in this analysis, there is a degree of uncertainty that accompanies these estimates. The embodied emissions reported here are intended to provide a sense of scale rather than precise accounting.

<sup>[9]</sup> The City of Eugene relied on Economic Input-Output Life-Cycle Analysis (EIO-LCA), a public-domain tool developed by Carnegie Mellon University, to estimate the emissions associated with producing the City's purchased goods and services. The EIO-LCA tool provides aggregate GHG emissions data per dollar of product purchased.

The total embodied emissions in City purchases for the 2010 calendar year were estimated at 26,300 MT CO<sub>2</sub>e, far outweighing Scope 1 and 2 emissions combined. Numbers reported are rounded to reflect the imprecision in the analysis. For reporting purposes, five broad categories of purchases were created by sorting expenditures based on the types of goods or services procured. These categories are Infrastructure Construction, Goods and Materials, Professional and Technical Services, Equipment and Furniture, and Facility Construction and Maintenance. Infrastructure Construction emissions are those associated with building roads, runways and stormwater systems as well as related cement, sand and gravel purchases. This is the largest single category and it represents about 60% of the City's Scope 3 embodied emissions <sup>[10]</sup>. Goods and Materials include chemicals used for treating swimming pools, hardware, office supplies, library materials cleaning supplies, and various other products necessary to provide government services. Professional and Technical Services represent a broad range of contractual services from architect and engineering services to legal consultation and temporary staffing services. The emissions in this category are reflective of the items and processes necessary to provide the deliverables (contractor's equipment, energy use, business travel, etc.). Equipment and Furniture consists of vehicles, computers, communication equipment and a variety of other equipment purchased throughout the organization. Facility Construction and Maintenance includes facility maintenance services such as painting, HVAC repair, plumbing services and building renovations.

The EIO-LCA model is based on averages of the U.S. economy as a whole and does not differentiate between types of purchases such as warm mix versus hot mix asphalt or virgin versus 100% recycled paper. Therefore, choices made to procure more sustainable products and services are not reflected within this analysis. Nevertheless, given the magnitude of the estimated embodied emissions associated with purchases, the implications of purchasing decisions are significant. This analysis will help the City to focus on products and services that have large GHG impacts.

<sup>[10]</sup> *Because of the nature of infrastructure construction and maintenance, it is common for this to be the largest category for municipal governments.*

## INVENTORY PROTOCOLS

### General Protocols:

This inventory follows the Local Government Operations Protocol, which provides the highest-consensus guidelines for minimum reporting scope and was developed jointly by The Climate Registry and other organizations<sup>[11]</sup>. However, the protocol only requires the reporting of emissions in Scopes 1 and 2 as defined by the World Resources Institute. This inventory has gone further to include several shared emissions categories from Scope 3. This use of additional high-quality public-domain tools to estimate Scope 3 emissions makes this inventory more state-of-the-art than inventories focused only on mandatory boundaries. This more integrated and holistic approach paints a more accurate portrait of total emissions associated with the activities carried out by the City of Eugene.

### Inventory Protocols

All emissions are reported in metric tons of carbon-dioxide equivalent (MT CO<sub>2</sub>e). The analysis attempts to cover all six “Kyoto gases” including: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), sulfur hexafluoride (SF<sub>6</sub>) and the groups of high global warming potential (GWP) gases, perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). Overwhelmingly, the direct and indirect CO<sub>2</sub>-equivalent emissions result from CO<sub>2</sub> from combustion of fossil fuels.

### General Precision:

The analysis drew on public-domain tools for emissions factors and methods. Emissions from some sources (such as natural gas consumption) were based on highly accurate data and accepted emissions factors. Emissions from other sources (such as employee commute) were estimated by combining available data with careful assumptions and sensitivity analyses. Still others were a mix of measurements and estimates. The level of precision is indicated within the explanation for each category.

## EXCLUDED EMISSIONS

The emissions associated with treating wastewater at the Metropolitan Wastewater Treatment Plant have been excluded from this inventory due to the shared nature of the facility. Because the facility is staffed by several partner agencies and management decisions are made by several partners under the umbrella of the Metro Wastewater Management Commission<sup>[12]</sup>, the Metropolitan Wastewater Management Commission will be conducting a separate greenhouse gas inventory. Emissions will then be allocated to all of the partnering municipal governments. When complete, this will add approximately 4,000 MT CO<sub>2</sub>e to the Scope 3 emissions.

<sup>[11]</sup> *The Local Government Operations (LGO) Protocol was developed as a collaboration of The Climate Registry (TCR), the California Air Resources Board (CARB), the California Climate Action Registry (CCAR, now the Climate Action Reserve), and ICLEI Local Governments for Sustainability. The LGO Protocol follows the same format as The Climate Registry's General Reporting Protocol (GRP).*

<sup>[12]</sup> *Metropolitan Wastewater Management Commission: [www.mwmcpartners.org](http://www.mwmcpartners.org)*

## **COST OF CARBON: QUANTIFICATION AND RISK**

Assembling a GHG inventory is an opportunity to analyze a particular kind of financial risk, i.e., the implications of a “cost of carbon” – a direct or indirect cost associated with GHG emissions, as a result of policy. Many analyses of proposed legislation have indicated a likely range of this cost, and we can see examples in countries that have already capped CO<sub>2</sub> emissions.

Recent EPA analysis of proposed climate policy suggests that, within a few years of implementing a cap-and-trade system, the cost of carbon could be around \$15 per MT CO<sub>2</sub>e. One proposed “reserve price” (or price floor) is \$10, while short-term “escape hatch” prices (or price ceilings) have been around \$30. This suggests a range between \$258,000 and \$516,000 annually to purchase offsets for scope 1 and 2 emissions. This range provides a sense of the City of Eugene’s total direct financial exposure related to a cost of carbon. Naturally there would be indirect financial exposure as the price for carbon intensive products (such as asphalt and steel) and services would be expected to increase as the price of carbon offsets are passed on to consumers, in this case, the City.

This total financial risk is unlikely to be borne entirely by the City of Eugene. Indeed, just as part of the carbon footprint is shared with others – from employees who commute to vendors that supply the organization with goods and services – the cost-of-carbon risk will likely be shared. This rough calculation is an approximation of the financial risk that could emerge under potential future climate policy scenarios.

## **SUSTAINABILITY EFFORTS AND CLIMATE ACTION AT CITY OF EUGENE**

The City of Eugene maintains an Internal Climate Action Plan (ICAP) stating priority actions, a clear timeframe and clear descriptions of progress. The ICAP and associated progress reports can be found online at [www.eugene-or.gov/sustainability](http://www.eugene-or.gov/sustainability)

## **CONTACT INFORMATION AND ADDITIONAL RESOURCES**

For more information contact Eugene Sustainability Liaison, Babe O'Sullivan at [babe.osullivan@ci.eugene.or.us](mailto:babe.osullivan@ci.eugene.or.us) or 541-682-5017.

This GHG inventory was completed as a part of City of Eugene's participation in Operation Climate Collaborative (OCC), a multi-jurisdictional process led by Good Company ([www.goodcompany.com](http://www.goodcompany.com)). Good Company facilitated the use of its proprietary calculation tool (Good Company's Carbon Calculator, or G3C), technical assistance related to and quality checks of the calculator's use, offered support and guidance in data gathering and the development of estimation methods, and provided the template for this document. City of Eugene staff prepared this report. For more information about OCC, visit [www.goodcompany.com/occ](http://www.goodcompany.com/occ) or contact Joshua Skov ([joshua.skov@goodcompany.com](mailto:joshua.skov@goodcompany.com), 541-341-4663, ext. 211).

